

ULTRAFINE & MICROFINE Cementitious Grouts

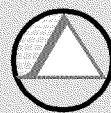
APS 3 μ

Microfractures at the Waste Isolation Pilot Plant repository filled with US Grout Ultrafine.



Producers of **Pozzolanic Cementitious Grouts**—Ultrafine and Microfine

IN EXCLUSIVE PARTNERSHIP WITH



AVANTI

Control groundwater.
Stabilize soil.
Stop leaks. Permanently.

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Ultrafine & Microfine Cementitious Grouts

Unique among all cementitious grouts produced in the world today, US Grouts are made with the same pumice-based pozzolan the Romans used over 2000 years ago. As proven by the Pantheon and many ancient Roman structures standing strong after 2 millennia, US Grout's patented pumice-pozzolan based cement provides unequalled longevity. Developed by the U.S. Department of Energy, the aptly named US Grout produces Ultrafine and Microfine products equal or superior to any ultrafine grout available in the marketplace.

A Superior Grout

All products are sourced, refined, and produced in the United States. They are supplied and supported by industry recognized grouting expert Avanti International. US Grout products are the professional choice for those critical grouting applications where only a superior, high-performance grout will do.

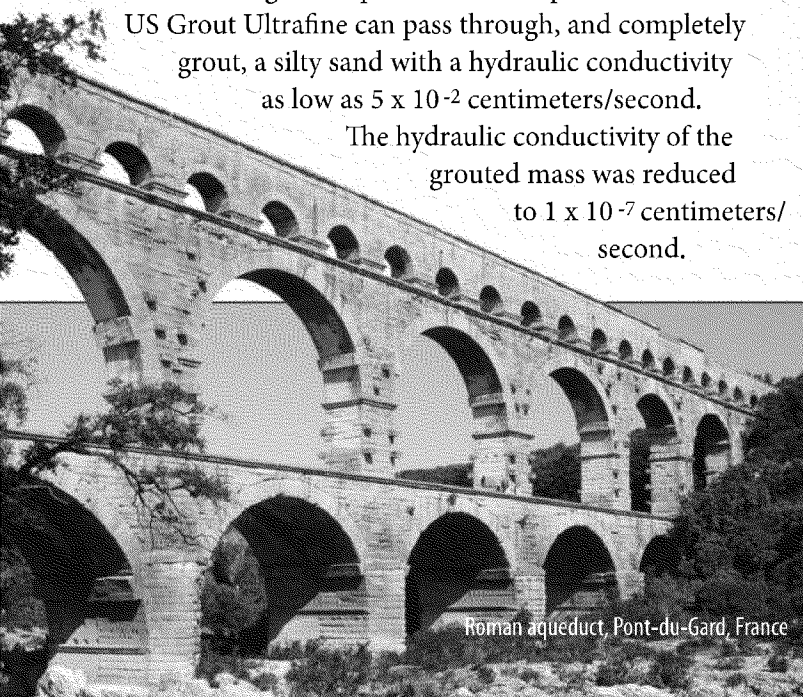
- US Grout products are ready to mix and pump without additional admixtures.
- Customized blends are available.
- Competitively priced; stable North American supply.
- Stringent quality control and modern plant facilities ensure uniformity.
- Expert technical support; international distribution network.
- Ultrafine and Microfine grouts will penetrate smaller fractures and finer-grained soils.
- Low internal cohesion means greater penetration and lower drilling costs.
- Composed of non-hazardous materials.

Permeation Grouting

An extensive, large scale permeation test proved that

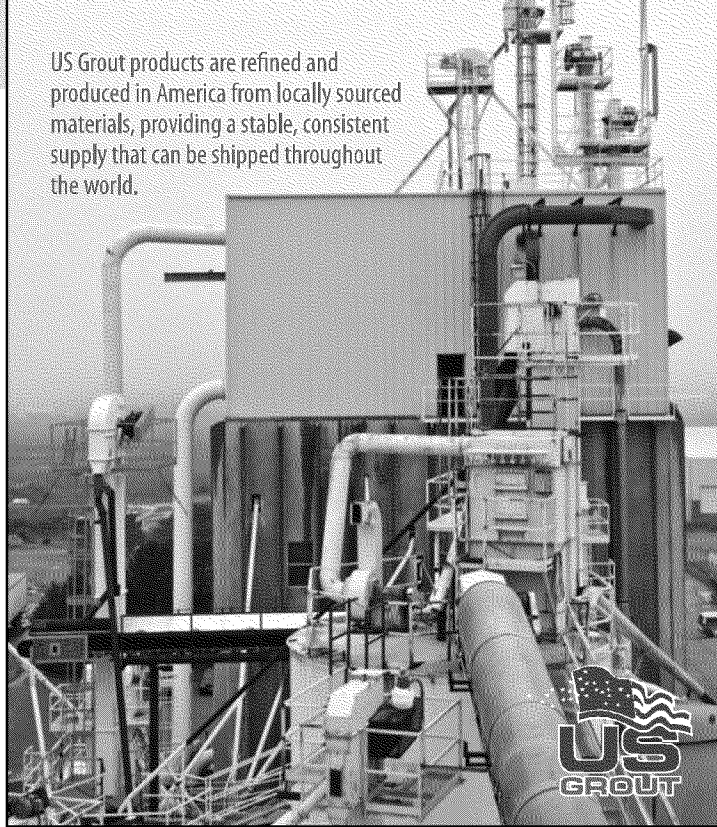
US Grout Ultrafine can pass through, and completely grout, a silty sand with a hydraulic conductivity as low as 5×10^{-2} centimeters/second.

The hydraulic conductivity of the grouted mass was reduced to 1×10^{-7} centimeters/second.



Roman aqueduct, Pont-du-Gard, France

US Grout products are refined and produced in America from locally sourced materials, providing a stable, consistent supply that can be shipped throughout the world.



Particle Size Information

Particle size and internal cohesion, *not viscosity*, determine a grout's ability to penetrate extremely small openings. 90% of the particles in Ultrafine grout are smaller than 8 microns and average 3 microns.*

Grout Characteristics

POZZOLANIC GROUTS ARE ENGINEERED FOR:

- Improved resistance to chemical attack due to lower alkalinity and very low hydraulic conductivity.
- Wide range of water to cement ratios.
- Little or no bleed at recommended water-to-grout ratios.
- Two-plus hours of injectability.
- Rheology and set time adjustable with various admixtures.
- Enhanced strength and decreased permeability.
- Volume stability, less than 0.1% linear shrinkage.
- Water soluble lime and alkalinity are greatly reduced.
- Extremely low hydraulic conductivity/permeability.
- A low heat of hydration resulting in higher resistance to thermal contraction cracking.
- Brine tolerant; applications in and around salt water.

*These sizes were determined by the Micro Meretics company, using their sedigraph.

The pozzolanic qualities of US Grout's pumice-based cements are legendary. The Romans built an empire on pozzolanic (pumice) concrete structures that endure to this day—some 2000 years later. Now, enhanced by state-of-the-art refining and injection processes, that same pozzolanic chemistry fortifies a high-performance grout that is superior in performance and effectiveness. Naturally.



Lake Mead Intake Tunnel #2

US Grout Ultrafine was used in Lake Mead Intake Tunnel #2 to successfully control the water inflow, enabling an on-time completion of the project.

US GROUT ULTRAFINE PROJECTS :

- stabilize and strengthen soil and sand
- seal seepage in mines, dams and tunnels
- fortify waste containment
- squeeze-grout and rehabilitate oil and gas wells
- form low-permeability grout curtains

Strategic Petroleum Reserve (SPR)

US Grout Ultrafine is used to successfully seal fractures in salt dome caverns in Louisiana that house a large part of the Strategic Petroleum Reserve.

Hollywood Metro Tunnel

US Grout Ultrafine was the product of choice to seal the Hollywood Metro Tunnel against water inflow and prevent settlement of the surface.

Waste Isolation Pilot Plant (WIPP)

US Grout Ultrafine was developed specifically to seal the extremely small fractures (often as small as 6 microns) around repository openings that compromised the seal of the storage tunnels more than 2000 feet below ground.

Soil Stabilization Project

To support a 9-story hotel, engineers required the compressive strength of the sandy soil be increased to a minimum of 250 psi. After using US Grout Ultrafine, the soil's compressive strength was over 800 psi in less than two weeks.

The project was a permeation grouting success that has been repeated hundreds of times around the world in varied soil types and conditions.

Additional project information at www.usgrout.com/USGrout-projects.html

TYPE V ULTRAFINE GROUT

DRY

PROPERTY	STANDARDS AND CONDITIONS	TYPICAL RESULTS
Dispersant	0.4% - 1% by weight of dry grout	
Color	Visual	Cement gray
Particle Size	SediGraph 5100	d90 <8 microns, average 3.0 microns
Surface Area	ASTM C-204 (Blaine Fineness)	15,110 cm ² /gram
Dry Loose Unit Weight		0.497 grams/cc
Dry Density (Specific Gravity)	ASTM C-188	2.70 grams/cm ³
Dry Weight/Wet Volume		1.01 kg/liter

WET

PROPERTY	STANDARDS AND CONDITIONS	TYPICAL RESULTS
Water/Grout		0.6/1 by weight of dry grout *
Wet Density (Specific Gravity)	API RP 13B-1 (Baroid Mud Balance)	1.54 - 1.56 grams/cc *
Initial Viscosity	API RP 13B-1 (Marsh Cone)	35 - 60 seconds *
Internal Cohesion	Lombardi Plate	1.22 Pascals *
Initial Gelation	Wally Baker Shear Value	2.5 - 5.0 hours *
Final Gelation	Wally Baker Shear Value	4.5 - 7.0 hours *
Initial Vicat Needle Set	ASTM C-191 (Vicat Needle)	9 - 10 hours *
Final Vicat Needle Set	ASTM C-191 (Vicat Needle)	10 - 11 hours *
Period of Workability		2.5 - 5.0 hours *
Compressive Strength	ASTM C 39/C 39M	>1000 psi @ 24 hours *
Shrinkage	ASTM C-490, C-596, C-157	-0.0260%
Bleeding	ASTM C-940	0.50%
Hydrational Heat	Adiabatic Chamber	31° C
Pressure Filtration	API Filter Press	0.100 - 0.103 minutes
Permeability	Custom Equipment at Atomic Energy of Canada	at Atomic Energy of Canada 1x10 ⁻¹⁶ m/second
Sulfate Resistant	Type V Sulfate Resistant Cement	Resistant to sulfate attack



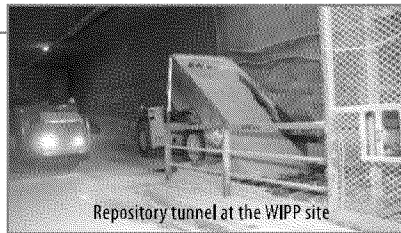
MIXING INSTRUCTIONS can be found at www.usgrout.com/grout-mixing-instructions.html

The characteristics itemized above are for a water/cement ratio of 0.6/1 by weight. Those items with an asterisk (*) can be adjusted as required by the application.

Developed by the U.S. Department of Energy

MANUFACTURED BY US GROUT • SUPPLIED & SUPPORTED BY AVANTI INTERNATIONAL

Sandia National Laboratories developed this ultrafine cementitious grout specifically for the stress micro-fractures in the deep repository tunnel openings at the U.S. Department of Energy's Waste Isolation Pilot Plant (WIPP). Sandia then secured a patent and transferred the manufacturing process, under license, to U.S. Grout, LLC. US Grout produces the finely-ground mixture of



Repository tunnel at the WIPP site

Portland cement, pumice, and superplasticizer in a state-of-the-art, computer-controlled manufacturing plant. Avanti International manages demand and ships world-wide, providing customer service, objective professional advice on product selection, material estimates, and the caliber of world-class technical support that only comes from 35 years of experience.



US Grout was injected into the earth around the Hollywood Metro Tunnel to stabilize the soil and create a nearly impermeable grout curtain, protecting against water inflow.



Sandy soil permeation tests—utilizing transparent sand columns—illustrate penetrability differences between Ultrafine and Standard cements.

100% American made and American sourced, Ultrafine and Microfine Cementitious Grouts are available in small bags, super sacks, and bulk pneumatics. Technical support is provided world-wide and available 24/7 by Avanti International.



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**Control groundwater.
Stabilize soil.
Stop leaks. Permanently.**

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FOR SALES OR INFORMATION

Contact: (800) 877.2570 or (281) 486.5600

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